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(54) ARRANGEMENT FOR INDICATING THE SWITCHING STATE OF AN  
OPTICAL COUPLER AND OPTICAL COUPLERS INCORPORATING SUCH  
AN ARRANGEMENT

(71) We, STANDARD TELEPHONES AND CABLES LIMITED, a British Company, of 190 Strand, London, W.C.2, England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to arrangements for indicating the switching state of a solid state optical coupler and to optical couplers incorporating such arrangements.

The switching state of a solid state optical coupler or isolator is often difficult to assess as the devices are very small and are generally employed in large numbers surrounded by coupler circuitry. Furthermore the leakage current of such devices can render 'in circuit' electrical tests unreliable.

The object of the invention is to minimise or to overcome these disadvantages.

According to the invention there is provided an arrangement for indicating the switching state of a semiconductor optical coupler, including a body of an up-converting anti-Stokes phosphor which, in use, is mounted adjacent the light emitting device of the coupler and is adapted to convert scattered radiation from the device to radiation of a visible wavelength, and means optically coupled to the phosphor body for displaying visible radiation emitted from the phosphor body.

According to the invention there is further provided an optical coupler device, including a plastics housing, a light emitting diode and a photosensitive device mounted in a co-operative relationship within the housing, and a body of an anti-Stokes phosphor adjacent the diode and adapted to convert scattered radiation from the diode to visible radiation, and in which the housing has an opening adjacent the phosphor body through which visible light emitted by the phosphor body is coupled to a lens or optical fibre.

The term 'optical coupler' or 'isolator' as used herein as understood to include devices which employ an infra-red emitting diode as

the 'light' source. It is well known that only a fraction of the light, or infra red radiation, generated by the light emitter of an optical coupler reaches the sensor device. The remainder of the light is lost by internal reflection and absorption or is lost by emission in directions away from the sensor. This scattered radiation may therefore be utilised to give an indication of the switching state of the device.

Embodiments of the invention will now be described with reference to the accompanying drawings in which Fig. 1 is a cross-section of an optical isolator fitted with a switching state indicator arrangement, and Fig. 2 is a cross-section of an alternative embodiment of the arrangement shown in Fig. 1.

Referring to Fig. 1, the arrangement includes a photosensitive semiconductor device 11 on which a light or, in most cases, an infra-red emitting diode 12 is mounted via a transparent isolator 13 so as to illuminate the active region of the device 11 to effect a switching function. The diode 12 is encased in a layer or body 14 of an up-converting anti-Stokes phosphor which converts scattered radiation from the device to a visible wavelength. The phosphor body 14 is covered with a layer 15 of a transparent silicone resin, preferably having a high refractive index and the whole arrangement is encapsulated in a plastics housing 16 having an opening 17 for receiving a transparent glass rod 18 which forms a lens for viewing the phosphor body 14. When the light emitting diode 12 is operated to effect switching of the underlying semiconductor device 11 the phosphor up-converts some of the scattered radiation to visible radiation to indicate the switching state of the device via the lens 18.

Fig. 2 shows a similar arrangement for use with an optical coupler in which the light emitting diode 21 and a mesa type photosensitive device 22 are mounted on a substrate 23 in a co-planar configuration. The gap between the diode and the photo-

sensitive device is filled with a suitable high refractive index material 24 such as a silicone resin and the diode 21 is coated with an anti-Stokes phosphor 25 which may extend  
5 over the gap between the diode 21 and the device 22. As before the phosphor 25 is covered with a layer 26 of a transparent silicone resin and the arrangement is encapsulated in a plastics housing 27 having an  
10 opening 28 for a glass or plastics lens 29 through which the phosphor 25 may be viewed.

In some applications the lens may be replaced by a glass or plastics optical fibre or  
15 fibres to convey the light output of the phosphor to a remote display panel, where the switching condition of several optical isolators may be displayed.

WHAT WE CLAIM IS:—

20 1. An arrangement for indicating the switching state of a semiconductor optical coupler, including a body of an up-converting anti-Stokes phosphor which, in use, is mounted adjacent the light emitting device of  
25 the coupler and is adapted to convert scattered radiation from the device to radiation of a visible wavelength, and means optically coupled to the phosphor body for displaying visible radiation emitted from the phosphor  
30 body.

2. An arrangement as claimed in claim 1, and in which the display means includes a glass or plastics lens adjacent the phosphor body.

3. An arrangement as claimed in claim 1, and in which the display means includes a glass or plastics optical fibre light guide arranged so as to receive the visible radiation from the phosphor body.

4. An arrangement for displaying the switching state of an optical coupler substantially as described herein with reference to Fig. 1 and Fig. 2 of the accompanying drawing.

5. An optical coupled device, including a plastics housing, a light emitting diode and a photosensitive device mounted in a co-operative relationship within the housing, and a body of an anti-Stokes phosphor adjacent the diode and adapted to convert scattered radiation from the diode to visible radiation, and in which the housing has an opening adjacent the phosphor body through which visible light emitted by the phosphor  
55 body is coupled to a lens or optical fibre.

6. An optical coupler device substantially as described herein with reference to Fig. 1 or Fig. 2 of the accompanying drawing.

7. A method of making an optical  
60 coupler device substantially as described herein with reference to Fig. 1 or Fig. 2 of the accompanying drawing.

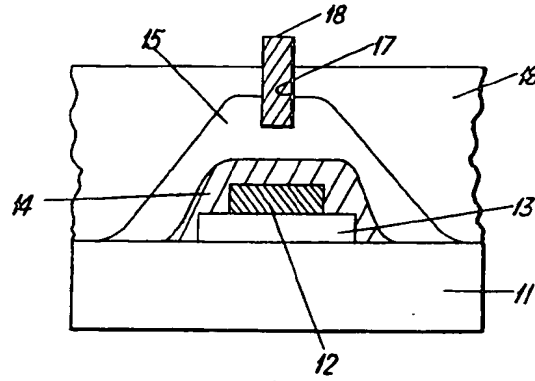
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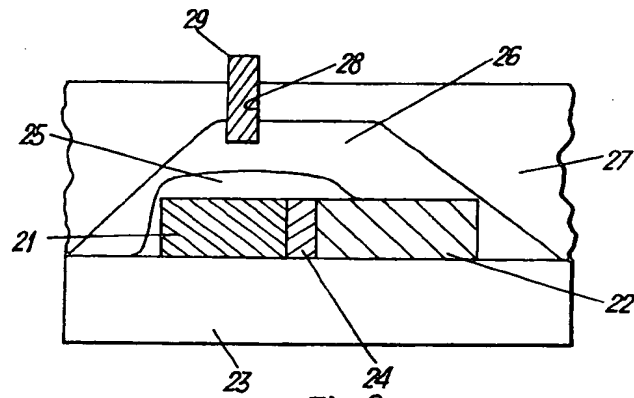
COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of  
the Original on a reduced scale



*Fig. 1.*



*Fig. 2.*



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